Medical Accounting

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Overview of Medical Coding and Its Role in Healthcare Payment Systems

In the complex landscape of healthcare, accurate and comprehensive documentation stands as a cornerstone for operational efficiency and financial stability. Healthcare staffing agencies help facilities maintain competitive workforce strategies **staffing agency for medical assistant** activity-based costing. One critical area where this is profoundly evident is in reducing denial rates by enhancing the quality of documentation. Denial rates, which refer to the percentage of claims rejected or denied by payers, can significantly impact a healthcare facility's revenue cycle management. Therefore, improving documentation practices is not just an administrative necessity but a strategic imperative to ensure fiscal health and patient care continuity.

The importance of accurate documentation cannot be overstated. It serves as the primary communication tool between healthcare providers and payers, conveying the medical necessity and details of services rendered. When documentation lacks precision or completeness, it can lead to misunderstandings or insufficient evidence for claim approval. This often results in denials that require time-consuming appeals processes or worse, forfeited reimbursements. By ensuring that every detail-from diagnosis codes to treatment narratives-is recorded with accuracy, healthcare providers can preemptively address potential reasons for denial.

Comprehensive documentation goes hand in hand with accuracy; it provides a holistic view of the patient's clinical journey. This includes not only what was done but why it was necessary within the context of each patient's unique circumstances. Such thoroughness ensures that insurance companies have all necessary information at their fingertips to process claims without delay or dispute. Moreover, comprehensive records facilitate better patient outcomes by promoting continuity of care-ensuring that any provider accessing the record has a complete understanding of previous treatments and decisions.

To achieve these standards, healthcare organizations must invest in training programs for their staff focused on best practices in medical documentation. Clinicians should be well-versed in using standardized terminologies and coding systems such as ICD-10 and CPT codes accurately to describe diagnoses and procedures performed. Furthermore, leveraging technology through electronic health records (EHRs) can streamline this process by providing tools for real-time data entry verification and decision support.

In addition to reducing denial rates, robust documentation practices also enhance audit readiness and compliance with regulatory requirements such as those mandated by Medicare and Medicaid. In an era where legal scrutiny over billing practices is intensifying, having detailed patient records acts as a safeguard against allegations of fraud or malpractice.

Ultimately, fostering a culture that prioritizes meticulous documentation contributes significantly to both financial sustainability and high-quality patient care delivery. As healthcare evolves with increasing complexity in treatments and payer requirements, steadfast attention to documenting each facet of patient interaction is more crucial than ever before.

Thus, by emphasizing accurate and comprehensive documentation within healthcare settings, institutions not only improve their bottom line through reduced denial rates but also fortify trust with patients who rely on them for reliable care-a testament to commitment beyond mere transactions towards genuine healing partnerships rooted in transparency and accountability.

Key Differences Between Fee for Service and Value Based Care Payment Models —

- **Future Trends: The Evolving Role of Medical Coders in a Value-Based Healthcare Environment**

In the complex world of healthcare, claim denials are a perennial challenge that can significantly impact the financial stability of medical practices. Among the myriad reasons for these denials, inadequate documentation stands out as a common culprit. Understanding and addressing this issue is essential for reducing denial rates and ensuring smooth operational workflows.

One primary cause of claim denials related to documentation is incomplete or missing information. In many cases, healthcare providers fail to include necessary details such as patient demographics, insurance information, or specific treatment codes. This oversight can lead to automatic rejections by insurers who require comprehensive data to process claims accurately. Ensuring that all fields in patient records are meticulously completed can mitigate this risk significantly.

Another frequent issue is the lack of specificity in clinical documentation. Medical procedures and diagnoses must be recorded with precise language and coding to align with insurance requirements. Vague descriptions or incorrect codes can result in discrepancies between what was performed and what was billed, leading insurers to deny claims due to perceived inaccuracies or inconsistencies.

Timeliness is also a critical factor in documentation-related denials. Delays in submitting claims often arise from procrastination or inefficient processes within medical offices. Many insurance companies have strict timelines for claim submissions, and missing these deadlines can lead to outright rejections. Implementing streamlined workflows and leveraging technology solutions such as electronic health records (EHR) systems can help ensure timely submission and reduce errors associated with manual entry.

Moreover, adherence to payer-specific guidelines is crucial for minimizing denials due to documentation errors. Each insurance company may have unique requirements concerning how services should be documented for reimbursement purposes. Failing to comply with these guidelines not only increases the likelihood of denial but also necessitates time-consuming appeals processes that could otherwise be avoided through proactive measures.

Improving provider education on proper documentation practices represents another pivotal strategy in reducing denial rates. Continuous training ensures that staff members stay updated

on regulatory changes, coding updates, and best practices for accurate record-keeping. Encouraging communication between clinicians and billing teams fosters an environment where questions about appropriate documentation standards can be promptly addressed.

In conclusion, while claim denials due to inadequate documentation pose significant challenges for healthcare providers, they also present opportunities for improvement through targeted strategies aimed at enhancing accuracy and efficiency in record-keeping practices. By focusing on complete data capture, specificity in clinical notes, timely submissions, compliance with payer rules, and ongoing education initiatives-healthcare organizations can effectively reduce their denial rates while simultaneously fostering better relationships with patients by maintaining transparency throughout billing processes.

Impact of Fee for Service on Medical Coding Practices

Improving documentation practices is a pivotal strategy for healthcare providers aiming to reduce denial rates. In the complex landscape of medical billing and reimbursements, precise and comprehensive documentation is not just beneficial-it is essential. Denials can arise from various factors, including coding errors, incomplete information, or discrepancies in patient data. Therefore, implementing effective documentation strategies can significantly enhance the accuracy of claims and lead to better financial outcomes for healthcare institutions.

One fundamental approach is the adoption of standardized documentation templates. These templates help ensure consistency across all entries and make it easier for healthcare professionals to capture necessary details without omitting critical information. By having a structured format that prompts for specific information, clinicians can provide thorough accounts of patient interactions, which are crucial during the billing process.

Training programs for staff also play an integral role in improving documentation quality. Regular workshops and seminars on current best practices in medical coding and billing equip healthcare professionals with up-to-date knowledge about regulatory requirements and industry standards. This continuous education helps prevent errors that could lead to claim denials while fostering a culture of meticulous attention to detail.

Moreover, leveraging technology through electronic health records (EHR) systems enhances documentation efficiency and accuracy. EHRs streamline data entry processes by integrating clinical workflows with billing operations, thereby reducing the likelihood of human error. Advanced features such as automated reminders or alerts can prompt practitioners to complete missing information before finalizing documentation.

Collaboration among healthcare teams further supports robust documentation practices. Encouraging open communication between clinicians, coders, and billing specialists ensures that any ambiguities or potential issues in patient records are addressed promptly. Such collaborative efforts enable a holistic understanding of each patient's case, minimizing oversights that could result in claim denials.

Finally, regular audits of medical records are instrumental in identifying patterns or recurring issues in documentation that might contribute to higher denial rates. Through these audits, organizations can pinpoint specific areas for improvement and implement corrective measures swiftly.

In conclusion, reducing denial rates through better documentation involves a multifaceted approach encompassing standardized templates, ongoing training programs, technological advancements like EHRs, cross-departmental collaboration, and routine audits. By investing time and resources into enhancing these areas, healthcare providers can improve their financial performance while ensuring compliance with payer requirements-a win-win scenario that ultimately benefits both providers and patients alike.

How Value Based Care Influences Medical Coding and Documentation Requirements

In the ever-evolving landscape of healthcare, the role of technology in enhancing documentation accuracy has become a cornerstone for reducing denial rates. As medical institutions strive to provide optimal patient care while maintaining financial viability, accurate documentation emerges as a critical factor in achieving these goals. Technology, with its transformative capabilities, offers a promising solution to the longstanding challenges associated with manual documentation processes.

At the heart of accurate documentation lies the need for precise and comprehensive records that reflect patient encounters and treatments accurately. Errors or omissions in these records can lead to significant issues, including claim denials by insurance companies. Such denials not only disrupt cash flow but also burden administrative staff with additional work as they attempt to rectify inaccuracies and resubmit claims. Herein lies the potential of technology: to streamline documentation processes, thereby minimizing errors and improving overall accuracy.

Electronic Health Records (EHRs) represent one of the most significant advancements in this domain. By digitizing patient information, EHRs eliminate many of the pitfalls associated with paper-based systems, such as illegible handwriting and misplaced files. They offer structured templates that guide healthcare providers through each step of patient interaction, ensuring that no critical information is overlooked. Moreover, EHRs enable real-time updates and access across multiple departments, fostering better communication and coordination among healthcare teams.

Artificial Intelligence (AI) further enhances documentation accuracy by automating repetitive tasks and providing predictive insights. AI-powered tools can scrutinize vast amounts of data quickly and identify patterns or anomalies that might escape human attention. For instance, natural language processing algorithms can analyze clinical notes to ensure they meet billing requirements before submission. This proactive approach reduces the likelihood of claim denials due to incomplete or inaccurate information.

Moreover, decision support systems integrated within EHR platforms offer recommendations based on best practices and clinical guidelines. These systems assist healthcare providers in making informed decisions while documenting encounters, thus aligning clinical actions with reimbursement criteria set forth by payers.

The integration of mobile technology also plays a pivotal role in enhancing documentation accuracy. Mobile applications allow healthcare professionals to document care at the point-of-service using smartphones or tablets. This immediacy reduces reliance on memory recall for

later entries-an often cited source of error-and ensures that documentation is contemporaneous with service delivery.

However, it is essential to acknowledge potential challenges accompanying technological integration into healthcare settings. Data security remains a paramount concern as digital records become increasingly vulnerable to breaches and cyberattacks. Ensuring compliance with regulations such as HIPAA is crucial to safeguarding patient confidentiality while reaping technological benefits.

In conclusion, technology holds immense promise in enhancing documentation accuracy within healthcare settings-a key strategy for reducing denial rates through better documentation practices. By leveraging EHRs, AI-driven tools, decision support systems, and mobile applications effectively; medical institutions can create robust frameworks that enhance both clinical outcomes and financial performance simultaneously while fostering an environment where precision becomes routine rather than exception

Challenges and Benefits of Transitioning from Fee for Service to Value Based Care in Medical Coding

In the complex world of healthcare, the accuracy and completeness of documentation play a critical role in ensuring that providers receive timely and appropriate reimbursement for their services. Denial rates, which refer to claims that are rejected by insurers for various reasons, remain a significant challenge for healthcare organizations. One of the most effective strategies for reducing denial rates is through better documentation, which requires targeted training and education for both healthcare providers and medical coders.

Healthcare providers are on the frontline of patient care and play a vital role in documenting each encounter accurately. Their notes form the basis upon which medical coders assign codes that determine billing and reimbursement. However, without proper training, even well-intentioned providers can make documentation errors or omissions that lead to claim denials. Education programs designed specifically for healthcare professionals can emphasize the importance of comprehensive medical records and highlight common pitfalls that result in denials.

For instance, workshops or seminars can focus on teaching providers how to document diagnoses with precision, ensure all relevant patient information is included, and understand payer-specific requirements. Providers should be encouraged to adopt a mindset where thorough documentation is viewed not merely as an administrative task but as an integral part of patient care. This approach not only enhances compliance but also supports continuity of care by providing future caregivers with complete patient histories.

On the other hand, medical coders must be adept at interpreting clinical notes accurately to assign appropriate codes based on current coding guidelines such as ICD-10-CM/PCS or CPT codes. Coders who are well-trained in these systems can bridge potential gaps between clinical language used by providers and coding requirements demanded by payers. Regular training sessions on updates in coding standards or payer policies help ensure coders remain proficient in translating clinical documentation into billable codes without errors.

Furthermore, fostering communication between healthcare providers and coders is essential. Creating opportunities for collaboration allows both parties to clarify ambiguities before claims are submitted. For example, implementing regular review meetings where difficult cases are discussed can improve understanding and reduce preventable denials.

Investing in ongoing education tailored towards enhancing documentation skills also has long-term economic benefits for healthcare institutions. Fewer denied claims mean reduced administrative costs associated with appeals processes and increased revenue from successful reimbursements. Moreover, it leads to improved relationships with patients who might otherwise face delays or complications due to unresolved billing issues.

Ultimately, reducing denial rates through better documentation hinges on cultivating a culture of continuous learning among both healthcare providers and coders. By equipping them with the necessary tools and knowledge through comprehensive training programs, organizations can significantly lower denial rates while simultaneously improving patient outcomes and financial health-a win-win scenario for all stakeholders involved in the intricate web of modern healthcare delivery systems.

Case Studies Highlighting the Effects of Different Payment Models on Medical Coding Efficiency

In the ever-evolving landscape of healthcare, reducing denial rates has become a critical focus for many organizations striving to optimize their revenue cycle management. One of the most effective strategies in achieving this goal is through better documentation, backed by robust monitoring and auditing processes for continued improvement.

Denials often stem from inadequate or inaccurate documentation, which can lead to significant financial losses for healthcare providers. To mitigate these issues, it is essential to establish a comprehensive documentation process that ensures all necessary information is accurately recorded and easily accessible. This process should be integrated into the daily workflow of healthcare professionals, emphasizing the importance of precise and thorough record-keeping at every stage of patient care.

However, implementing a strong documentation system alone is not enough. Continuous monitoring and auditing are vital components in maintaining and improving the quality of documentation over time. Monitoring involves regularly reviewing current practices to identify any gaps or inconsistencies in documentation that could lead to denials. This proactive approach allows healthcare organizations to address potential issues before they result in denied claims.

Auditing complements monitoring by providing an in-depth analysis of past performance. Through systematic audits, organizations can evaluate the effectiveness of their

documentation practices and determine areas that require improvement. Audits should be conducted regularly and involve a review of both clinical and administrative records to ensure comprehensive compliance with regulatory standards and payer requirements.

Moreover, feedback from monitoring and auditing processes should be used constructively to foster a culture of continuous improvement within the organization. Healthcare providers must be open to adapting their practices based on audit findings and industry trends. Regular training sessions can equip staff with up-to-date knowledge on best practices for documentation, ultimately leading to more accurate claims submissions.

By focusing on enhancing documentation through meticulous monitoring and auditing, healthcare organizations can significantly reduce denial rates. This not only improves financial outcomes but also enhances overall operational efficiency and patient satisfaction. As such, investing in these processes is not just about immediate gains; it's about building a resilient system capable of adapting to future challenges in the dynamic field of healthcare.

In conclusion, reducing denial rates through better documentation requires more than just initial improvements; it demands ongoing commitment through rigorous monitoring and auditing processes. By embracing this continuous cycle of evaluation and refinement, healthcare providers can ensure sustainable improvements that benefit both their financial health and the quality of care they deliver.

Future Trends: The Evolving Role of Medical Coders in a Value-Based Healthcare

Environment

In the complex world of healthcare, one persistent challenge that providers face is managing claim denials. Denial rates can significantly impact a healthcare organization's revenue cycle, adding unnecessary burdens to administrative staff and potentially affecting patient care. However, through strategic improvements in documentation practices, many organizations have successfully reduced their denial rates, enhancing both operational efficiency and financial stability. Here are some insightful case studies and examples illustrating how better documentation has played a pivotal role in achieving this goal.

Consider the case of St. Mary's Hospital, a mid-sized community hospital that was struggling with high denial rates primarily due to insufficient and inaccurate documentation. By implementing a comprehensive training program for their clinical staff focused on accurate record-keeping and coding practices, St. Mary's witnessed a remarkable turnaround. The program emphasized the importance of precise language in clinical notes and the necessity for complete documentation of all patient interactions and treatments.

In addition to training, St. Mary's invested in advanced electronic health records (EHR) systems with built-in prompts that guided clinicians through the documentation process, ensuring completeness before submission for billing. Within six months of these initiatives, the hospital reported a 30% reduction in claim denial rates. This improvement not only eased administrative workloads but also accelerated cash flow by reducing delays caused by resubmissions and appeals.

Another compelling example is seen in Sunshine Health Group, an integrated health system comprising multiple clinics and specialty services. They faced frequent denials related to medical necessity due to vague or incomplete clinical justifications in patient files. To combat this issue, Sunshine Health Group adopted a multidisciplinary approach involving collaboration between physicians, coders, and billing specialists.

The organization established regular workshops where teams reviewed denied claims together to identify patterns and areas needing improvement in their documentation

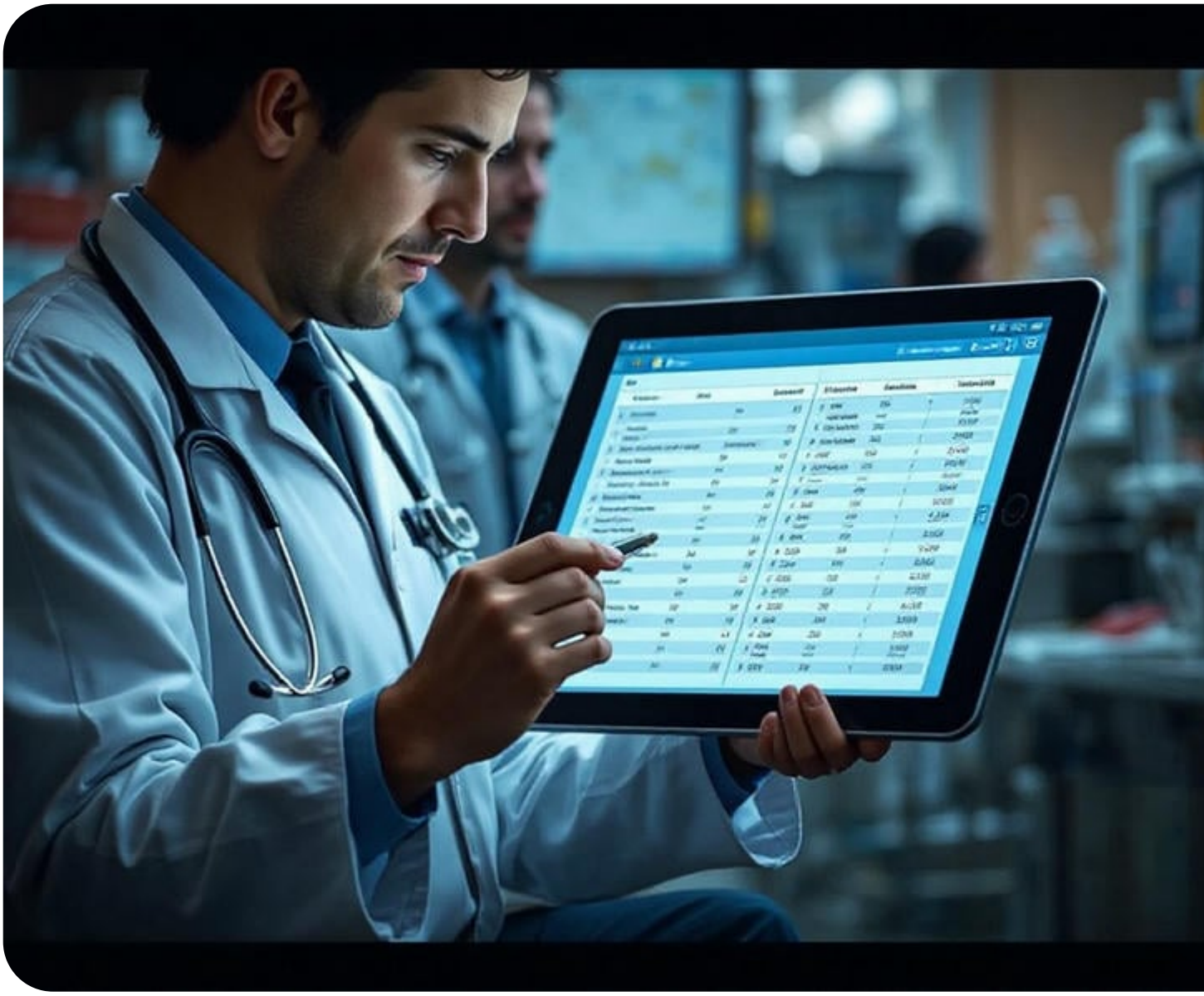
processes. As part of this collaborative effort, they developed standardized templates tailored for specific diagnoses that ensured all necessary information was captured consistently across different departments.

This initiative paid off handsomely as it fostered an environment where clinicians became more aware of how their notes impacted billing outcomes directly. Consequently, Sunshine Health Group achieved a 40% reduction in denial rates within the first year after implementing these changes.

Lastly, we look at Riverbend Medical Center's innovative use of technology to enhance documentation accuracy-a crucial factor in reducing denials related to coding errors or missing information. By integrating natural language processing (NLP) tools into their EHR systems, Riverbend enabled automatic extraction of relevant data from physician notes directly into billing codes.

This seamless integration minimized human error associated with manual data entry while allowing physicians more time to focus on patient care rather than administrative tasks. The adoption of such cutting-edge technology resulted not only in significant reductions-upwards of 50%-in denials but also improved overall clinician satisfaction due to decreased clerical burdens.

These case studies highlight that while challenges around claim denials are multifaceted; targeted interventions centered on improving documentation can yield substantial benefits for healthcare organizations looking to optimize their revenue cycles effectively. Whether through enhanced training programs like at St. Mary's Hospital or leveraging technology solutions as demonstrated by Riverbend Medical Center-improving documentation is indeed a powerful strategy for reducing denial rates successfully across diverse healthcare settings.



About learning

For the album by Perfume Genius, see *Learning* (album).
Several terms redirect here. For other uses, see Learn (disambiguation), Learned (disambiguation), and Learners (film).

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American students learning how to make and roll sushi

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Cognitive psychology

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Perception

- Visual
- Object recognition
- Face recognition
- Pattern recognition

Attention

Memory

- Aging
- Emotional
- Learning
- Long-term

Metacognition

Language

Metalanguage

Thinking

- Cognition
- Concept
- Reasoning
- Decision making
- Problem solving

Numerical cognition

- Numerosity adaptation effect
- Approximate number system
- Parallel individuation system

Learning is the process of acquiring new understanding, knowledge, behaviors, skills, values, attitudes, and preferences.[1] The ability to learn is possessed by humans, non-human animals, and some machines; there is also evidence for some kind of learning in certain plants.[2] Some learning is immediate, induced by a single event (e.g. being burned by a hot stove), but much skill and knowledge accumulate from repeated experiences.[3] The changes induced by learning often last a lifetime, and it is hard to distinguish learned material that seems to be "lost" from that which cannot be retrieved.[4]

Human learning starts at birth (it might even start before[5]) and continues until death as a consequence of ongoing interactions between people and their environment. The nature and processes involved in learning are studied in many established fields (including educational psychology, neuropsychology, experimental psychology, cognitive sciences, and pedagogy), as well as emerging fields of knowledge (e.g. with a shared interest in the topic of learning from safety events such as incidents/accidents,[6] or in collaborative learning health systems[7]). Research in such fields has led to the identification of various sorts of learning. For example, learning may occur as a result of habituation, or classical conditioning, operant conditioning or as a result of more complex activities such as play, seen only in relatively intelligent animals.[8][9] Learning may occur consciously or without conscious awareness. Learning that an aversive event cannot be avoided or escaped may result in a condition called learned helplessness.[10] There is evidence for human behavioral learning prenatally, in which habituation has been observed as early as 32 weeks into gestation, indicating that the central nervous system is sufficiently developed and primed for learning and memory to occur very early on in development.[11]

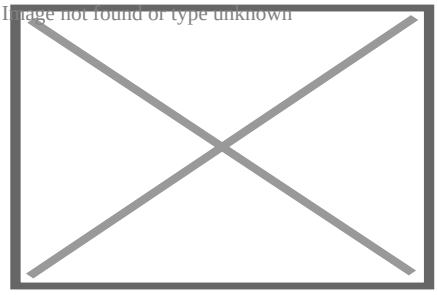
Play has been approached by several theorists as a form of learning. Children experiment with the world, learn the rules, and learn to interact through play. Lev Vygotsky agrees that play is pivotal for children's development, since they make meaning of their environment through playing educational games. For Vygotsky, however, play is the first form of learning language and communication, and the stage where a child begins to understand rules and symbols.[12] This has led to a view that learning in organisms is always related to semiosis,[13] and is often associated with representational systems/activity.[14]

Types

[edit]

See also: Learning styles and Machine learning § Types of problems and tasks

There are various functional categorizations of memory which have developed. Some memory researchers distinguish memory based on the relationship between the stimuli involved (associative vs non-associative) or based to whether the content can be communicated through language (declarative/explicit vs procedural/implicit). Some of these categories can, in turn, be parsed into sub-types. For instance, declarative memory comprises both episodic and semantic memory.



Children learn to bike in the eighties in Czechoslovakia.

Non-associative learning

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Non-associative learning refers to "a relatively permanent change in the strength of response to a single stimulus due to repeated exposure to that stimulus."[15] This definition exempts the changes caused by sensory adaptation, fatigue, or injury.[16]

Non-associative learning can be divided into habituation and sensitization.

Habituation

[edit]
Main article: Habituation

Habituation is an example of non-associative learning in which one or more components of an innate response (e.g., response probability, response duration) to a stimulus diminishes when the stimulus is repeated. Thus, habituation must be distinguished from extinction, which is an associative process. In operant extinction, for example, a response declines because it is no longer followed by a reward. An example of habituation can be seen in small song birds—if a stuffed owl (or similar predator) is put into the cage, the birds initially react to it as though it were a real predator. Soon the birds react less, showing habituation. If another stuffed owl is introduced (or the same one removed and re-introduced), the birds react to it again as though it were a predator,

demonstrating that it is only a very specific stimulus that is habituated to (namely, one particular unmoving owl in one place). The habituation process is faster for stimuli that occur at a high rather than for stimuli that occur at a low rate as well as for the weak and strong stimuli, respectively.[17] Habituation has been shown in essentially every species of animal, as well as the sensitive plant *Mimosa pudica*[18] and the large protozoan *Stentor coeruleus*.[19] This concept acts in direct opposition to sensitization.[17]

Sensitization

[edit]
Main article: Sensitization

Sensitization is an example of non-associative learning in which the progressive amplification of a response follows repeated administrations of a stimulus.[20] This is based on the notion that a defensive reflex to a stimulus such as withdrawal or escape becomes stronger after the exposure to a different harmful or threatening stimulus.[21] An everyday example of this mechanism is the repeated tonic stimulation of peripheral nerves that occurs if a person rubs their arm continuously. After a while, this stimulation creates a warm sensation that can eventually turn painful. This pain results from a progressively amplified synaptic response of the peripheral nerves. This sends a warning that the stimulation is harmful.[22][*clarification needed*] Sensitization is thought to underlie both adaptive as well as maladaptive learning processes in the organism.[23][*citation*

Active learning

[edit]
Main article: Active learning

Active learning occurs when a person takes control of his/her learning experience. Since understanding information is the key aspect of learning, it is important for learners to recognize what they understand and what they do not. By doing so, they can monitor their own mastery of subjects. Active learning encourages learners to have an internal dialogue in which they verbalize understandings. This and other meta-cognitive strategies can be taught to a child over time. Studies within metacognition have proven the value in active learning, claiming that the learning is usually at a stronger level as a result.[24] In addition, learners have more incentive to learn when they have control over not only how they learn but also what they learn.[25] Active learning is a key characteristic of student-centered learning. Conversely, passive learning and direct instruction are characteristics of teacher-centered learning (or traditional education).

Associative learning

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Associative learning is the process by which a person or animal learns an association between two stimuli or events.[26] In classical conditioning, a previously neutral stimulus is repeatedly paired with a reflex-eliciting stimulus until eventually the neutral stimulus elicits a response on its own. In operant conditioning, a behavior that is reinforced or punished in the presence of a stimulus becomes more or less likely to occur in the presence of that stimulus.

Operant conditioning

[edit]
Main article: Operant conditioning

Operant conditioning is a way in which behavior can be shaped or modified according to the desires of the trainer or head individual. Operant conditioning uses the thought that living things seek pleasure and avoid pain, and that an animal or human can learn through receiving either reward or punishment at a specific time called trace conditioning. Trace conditioning is the small and ideal period of time between the subject performing the desired behavior, and receiving the positive reinforcement as a result of their performance. The reward needs to be given immediately after the completion of the wanted behavior.[27]

Operant conditioning is different from classical conditioning in that it shapes behavior not solely on bodily reflexes that occur naturally to a specific stimulus, but rather focuses on the shaping of wanted behavior that requires conscious thought, and ultimately requires learning.[28]

Punishment and reinforcement are the two principal ways in which operant conditioning occurs. Punishment is used to reduce unwanted behavior, and ultimately (from the learner's perspective) leads to avoidance of the punishment, not necessarily avoidance of the unwanted behavior. Punishment is not an appropriate way to increase wanted behavior for animals or humans. Punishment can be divided into two subcategories, positive punishment and negative punishment. Positive punishment is when an aversive aspect of life or thing is added to the subject, for this reason it is called positive punishment. For example, the parent spanking their child would be considered a positive punishment, because a spanking was added to the child. Negative punishment is considered the removal of something loved or desirable from the subject. For example, when a parent puts his child in time out, in reality, the child is losing the opportunity to be with friends, or to enjoy the freedom to do as he pleases. In this example, negative punishment is the removal of the child's desired rights to play with his friends etc.[29][30]

Reinforcement on the other hand is used to increase a wanted behavior either through negative reinforcement or positive reinforcement. Negative reinforcement is defined by removing an undesirable aspect of life, or thing. For example, a dog might learn to sit as the trainer scratches his ears, which ultimately is removing his itches (undesirable aspect). Positive reinforcement is defined by adding a desirable aspect of life or thing. For example, a dog might learn to sit if he receives a treat. In this example the treat was added to the dog's life.[29][30]

Classical conditioning

[edit]
Main article: Classical conditioning

The typical paradigm for *classical conditioning* involves repeatedly pairing an unconditioned stimulus (which unfailingly evokes a reflexive response) with another previously neutral stimulus (which does not normally evoke the response). Following conditioning, the response occurs both to the unconditioned stimulus and to the other, unrelated stimulus (now referred to as the "conditioned stimulus"). The response to the conditioned stimulus is termed a *conditioned response*. The classic example is Ivan Pavlov and his dogs.[21] Pavlov fed his dogs meat powder, which naturally made the dogs salivate—salivating is a reflexive response to the meat powder. Meat powder is the unconditioned stimulus (US) and the salivation is the unconditioned response (UR). Pavlov rang a bell before presenting the meat powder. The first time Pavlov rang the bell, the neutral stimulus, the dogs did not salivate, but once he put the meat powder in their mouths they began to salivate. After numerous pairings of bell and food, the dogs learned that the bell signaled that food was about to come, and began to salivate when they heard the bell. Once this occurred, the bell became the conditioned stimulus (CS) and the salivation to the bell became the conditioned response (CR). Classical conditioning has been demonstrated in many species. For example, it is seen in honeybees, in the proboscis extension reflex paradigm.[31] It was recently also demonstrated in garden pea plants.[32]

Another influential person in the world of classical conditioning is John B. Watson. Watson's work was very influential and paved the way for B.F. Skinner's radical behaviorism. Watson's behaviorism (and philosophy of science) stood in direct contrast to Freud and other accounts based largely on introspection. Watson's view was that the introspective method was too subjective and that we should limit the study of human development to directly observable behaviors. In 1913, Watson published the article "Psychology as the Behaviorist Views", in which he argued that laboratory studies should serve psychology best as a science. Watson's most famous, and controversial, experiment was "Little Albert", where he demonstrated how psychologists can account for the learning of emotion through classical conditioning principles.

Observational learning

[edit]
Main article: Observational learning

Observational learning is learning that occurs through observing the behavior of others. It is a form of social learning which takes various forms, based on various processes. In humans, this form of learning seems to not need reinforcement to occur, but instead, requires a social model such as a parent, sibling, friend, or teacher with surroundings.

Imprinting

[edit]
Main article: Imprinting (psychology)

Imprinting is a kind of learning occurring at a particular life stage that is rapid and apparently independent of the consequences of behavior. In filial imprinting, young animals, particularly birds, form an association with another individual or in some cases, an object, that they respond to as they would to a parent. In 1935, the Austrian Zoologist Konrad Lorenz discovered that certain birds follow and form a bond if the object makes sounds.

Play

[edit]
Main article: Play (activity)

Play generally describes behavior with no particular end in itself, but that improves performance in similar future situations. This is seen in a wide variety of vertebrates besides humans, but is mostly limited to mammals and birds. Cats are known to play with a ball of string when young, which gives them experience with catching prey. Besides inanimate objects, animals may play with other members of their own species or other animals, such as orcas playing with seals they have caught. Play involves a significant cost to animals, such as increased vulnerability to predators and the risk of injury and possibly infection. It also consumes energy, so there must be significant benefits associated with play for it to have evolved. Play is generally seen in younger animals, suggesting a link with learning. However, it may also have other benefits not associated directly with learning, for example improving physical fitness.

Play, as it pertains to humans as a form of learning is central to a child's learning and development. Through play, children learn social skills such as sharing and

collaboration. Children develop emotional skills such as learning to deal with the emotion of anger, through play activities. As a form of learning, play also facilitates the development of thinking and language skills in children.[33]

There are five types of play:

1. Sensorimotor play aka functional play, characterized by the repetition of an activity
2. Roleplay occurs starting at the age of three
3. Rule-based play where authoritative prescribed codes of conduct are primary
4. Construction play involves experimentation and building
5. Movement play aka physical play[33]

These five types of play are often intersecting. All types of play generate thinking and problem-solving skills in children. Children learn to think creatively when they learn through play.[34] Specific activities involved in each type of play change over time as humans progress through the lifespan. Play as a form of learning, can occur solitarily, or involve interacting with others.

Enculturation

[edit]
Main article: Enculturation

Enculturation is the process by which people learn values and behaviors that are appropriate or necessary in their surrounding culture.[35] Parents, other adults, and peers shape the individual's understanding of these values.[35] If successful, enculturation results in competence in the language, values, and rituals of the culture.[35] This is different from acculturation, where a person adopts the values and societal rules of a culture different from their native one.

Multiple examples of enculturation can be found cross-culturally. Collaborative practices in the Mazahua people have shown that participation in everyday interaction and later learning activities contributed to enculturation rooted in nonverbal social experience.[36] As the children participated in everyday activities, they learned the cultural significance of these interactions. The collaborative and helpful behaviors exhibited by Mexican and Mexican-heritage children is a cultural practice known as being "acomedido".[37] Chillihuani girls in Peru described themselves as weaving constantly, following behavior shown by the other adults.[38]

Episodic learning

[edit]

Episodic learning is a change in behavior that occurs as a result of an event.[39] For example, a fear of dogs that follows being bitten by a dog is episodic learning. Episodic learning is so named because events are recorded into episodic memory, which is one of the three forms of explicit learning and retrieval, along with perceptual memory and semantic memory.[40] Episodic memory remembers events and history that are embedded in experience and this is distinguished from semantic memory, which attempts to extract facts out of their experiential context[41] or – as some describe – a timeless organization of knowledge.[42] For instance, if a person remembers the Grand Canyon from a recent visit, it is an episodic memory. He would use semantic memory to answer someone who would ask him information such as where the Grand Canyon is. A study revealed that humans are very accurate in the recognition of episodic memory even without deliberate intention to memorize it.[43] This is said to indicate a very large storage capacity of the brain for things that people pay attention to.[43]

Multimedia learning

[edit]
Main article: Multimedia learning

Multimedia learning is where a person uses both auditory and visual stimuli to learn information.[44] This type of learning relies on dual-coding theory.[45]

E-learning and augmented learning

[edit]
Main article: Electronic learning

Electronic learning or e-learning is computer-enhanced learning. A specific and always more diffused e-learning is mobile learning (m-learning), which uses different mobile telecommunication equipment, such as cellular phones.

When a learner interacts with the e-learning environment, it is called augmented learning. By adapting to the needs of individuals, the context-driven instruction can be dynamically tailored to the learner's natural environment. Augmented digital content may include text, images, video, audio (music and voice). By personalizing instruction, augmented learning has been shown to improve learning performance for a lifetime.[46] See also minimally invasive education.

Moore (1989)[47] purported that three core types of interaction are necessary for quality, effective online learning:

- Learner–learner (i.e. communication between and among peers with or without the teacher present),

- Learner–instructor (i.e. student-teacher communication), and
- Learner–content (i.e. intellectually interacting with content that results in changes in learners' understanding, perceptions, and cognitive structures).

In his theory of transactional distance, Moore (1993)[48] contented that structure and interaction or dialogue bridge the gap in understanding and communication that is created by geographical distances (known as transactional distance).

Rote learning

[edit]
Main article: Rote learning

Rote learning is memorizing information so that it can be recalled by the learner exactly the way it was read or heard. The major technique used for rote learning is *learning by repetition*, based on the idea that a learner can recall the material exactly (but not its meaning) if the information is repeatedly processed. Rote learning is used in diverse areas, from mathematics to music to religion.

Meaningful learning

[edit]
See also: Deeper learning

Meaningful learning is the concept that learned knowledge (e.g., a fact) is fully understood to the extent that it relates to other knowledge. To this end, meaningful learning contrasts with rote learning in which information is acquired without regard to understanding. Meaningful learning, on the other hand, implies there is a comprehensive knowledge of the context of the facts learned.[49]

Evidence-based learning

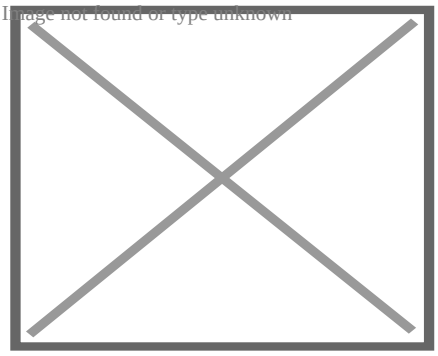
[edit]
Main article: Evidence-based learning

Evidence-based learning is the use of evidence from well designed scientific studies to accelerate learning. Evidence-based learning methods such as spaced repetition can increase the rate at which a student learns.[50]

Formal learning

[edit]

Main article: Education



A depiction of the world's oldest continually operating university, the University of Bologna, Italy

Formal learning is a deliberate way attaining of knowledge, which takes place within a teacher-student environment, such as in a school system or work environment.[51][52] The term formal learning has nothing to do with the formality of the learning, but rather the way it is directed and organized. In formal learning, the learning or training departments set out the goals and objectives of the learning and oftentimes learners will be awarded with a diploma, or a type of formal recognition.[51][53]

Non-formal learning

[edit]
Main article: Nonformal learning

Non-formal learning is organized learning outside the formal learning system. For example, learning by coming together with people with similar interests and exchanging viewpoints, in clubs or in (international) youth organizations, and workshops. From the organizer's point of reference, non-formal learning does not always need a main objective or learning outcome. From the learner's point of view, non-formal learning, although not focused on outcomes, often results in an intentional learning opportunity.[54]

Informal learning

[edit]
Main article: Informal learning

Informal learning is less structured than "non-formal learning". It may occur through the experience of day-to-day situations (for example, one would learn to look ahead while walking because of the possible dangers inherent in not paying attention to where one is going). It is learning from life, during a meal at the table with parents, during play, and

while exploring etc.. For the learner, informal learning is most often an experience of happenstance, and not a deliberately planned experience. Thus this does not require enrollment into any class. Unlike formal learning, informal learning typically does not lead to accreditation.[54] Informal learning begins to unfold as the learner ponders his or her situation. This type of learning does not require a professor of any kind, and learning outcomes are unforeseen following the learning experience.[55]

Informal learning is self-directed and because it focuses on day-to-day situations, the value of informal learning can be considered high. As a result, information retrieved from informal learning experiences will likely be applicable to daily life.[56] Children with informal learning can at times yield stronger support than subjects with formal learning in the topic of mathematics.[57] Daily life experiences take place in the workforce, family life, and any other situation that may arise during one's lifetime. Informal learning is voluntary from the learner's viewpoint, and may require making mistakes and learning from them. Informal learning allows the individual to discover coping strategies for difficult emotions that may arise while learning. From the learner's perspective, informal learning can become purposeful, because the learner chooses which rate is appropriate to learn and because this type of learning tends to take place within smaller groups or by oneself.[56]

Nonformal learning and combined approaches

[edit]

The educational system may use a combination of formal, informal, and nonformal learning methods. The UN and EU recognize these different forms of learning (cf. links below). In some schools, students can get points that count in the formal-learning systems if they get work done in informal-learning circuits. They may be given time to assist international youth workshops and training courses, on the condition they prepare, contribute, share, and can prove this offered valuable new insight, helped to acquire new skills, a place to get experience in organizing, teaching, etc.

To learn a skill, such as solving a Rubik's Cube quickly, several factors come into play at once:

- Reading directions helps a player learn the patterns that solve the Rubik's Cube.
- Practicing the moves repeatedly helps build "muscle memory" and speed.
- Thinking critically about moves helps find shortcuts, which speeds future attempts.
- Observing the Rubik's Cube's six colors help anchor solutions in the mind.
- Revisiting the cube occasionally helps retain the skill.

Tangential learning

[edit]

Tangential learning is the process by which people self-educate if a topic is exposed to them in a context that they already enjoy. For example, after playing a music-based video game, some people may be motivated to learn how to play a real instrument, or after watching a TV show that references Faust and Lovecraft, some people may be inspired to read the original work.[58] Self-education can be improved with systematization. According to experts in natural learning, self-oriented learning training has proven an effective tool for assisting independent learners with the natural phases of learning.[59]

Extra Credits writer and game designer James Portnow was the first to suggest games as a potential venue for "tangential learning".[60] Mozelius *et al.*[61] points out that intrinsic integration of learning content seems to be a crucial design factor, and that games that include modules for further self-studies tend to present good results. The built-in encyclopedias in the *Civilization* games are presented as an example – by using these modules gamers can dig deeper for knowledge about historical events in the gameplay. The importance of rules that regulate learning modules and game experience is discussed by Moreno, C.,[62] in a case study about the mobile game Kiwaka. In this game, developed by Landka in collaboration with ESA and ESO, progress is rewarded with educational content, as opposed to traditional education games where learning activities are rewarded with gameplay.[63][64]

Dialogic learning

[edit]
Main article: Dialogic learning

Dialogic learning is a type of learning based on dialogue.

Incidental learning

[edit]

In *incidental teaching* learning is not planned by the instructor or the student, it occurs as a byproduct of another activity — an experience, observation, self-reflection, interaction, unique event (e.g. in response to incidents/accidents), or common routine task. This learning happens in addition to or apart from the instructor's plans and the student's expectations. An example of incidental teaching is when the instructor places a train set on top of a cabinet. If the child points or walks towards the cabinet, the instructor prompts the student to say "train". Once the student says "train", he gets access to the train set.

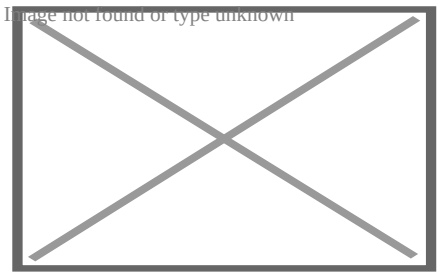
Here are some steps most commonly used in incidental teaching:[65]

- An instructor will arrange the learning environment so that necessary materials are within the student's sight, but not within his reach, thus impacting his motivation to seek out those materials.
- An instructor waits for the student to initiate engagement.
- An instructor prompts the student to respond if needed.
- An instructor allows access to an item/activity contingent on a correct response from the student.
- The instructor fades out the prompting process over a period of time and subsequent trials.

Incidental learning is an occurrence that is not generally accounted for using the traditional methods of instructional objectives and outcomes assessment. This type of learning occurs in part as a product of social interaction and active involvement in both online and onsite courses. Research implies that some un-assessed aspects of onsite and online learning challenge the equivalency of education between the two modalities. Both onsite and online learning have distinct advantages with traditional on-campus students experiencing higher degrees of incidental learning in three times as many areas as online students. Additional research is called for to investigate the implications of these findings both conceptually and pedagogically.[66]

Domains

[edit]



Future school (1901 or 1910)

Benjamin Bloom has suggested three domains of learning in his taxonomy which are:

- Cognitive: To recall, calculate, discuss, analyze, problem solve, etc.
- Psychomotor: To dance, swim, ski, dive, drive a car, ride a bike, etc.
- Affective: To like something or someone, love, appreciate, fear, hate, worship, etc.

These domains are not mutually exclusive. For example, in learning to play chess, the person must learn the rules (cognitive domain)—but must also learn how to set up the chess pieces and how to properly hold and move a chess piece (psychomotor). Furthermore, later in the game the person may even learn to love the game itself, value its applications in life, and appreciate its history (affective domain).[67]

Transfer

[edit]

Transfer of learning is the application of skill, knowledge or understanding to resolve a novel problem or situation that happens when certain conditions are fulfilled. Research indicates that learning transfer is infrequent; most common when "... cued, primed, and guided..."[68] and has sought to clarify what it is, and how it might be promoted through instruction.

Over the history of its discourse, various hypotheses and definitions have been advanced. First, it is speculated that different types of transfer exist, including: near transfer, the application of skill to solve a novel problem in a similar context; and far transfer, the application of skill to solve a novel problem presented in a different context.[69] Furthermore, Perkins and Salomon (1992) suggest that positive transfer in cases when learning supports novel problem solving, and negative transfer occurs when prior learning inhibits performance on highly correlated tasks, such as second or third-language learning.[70] Concepts of positive and negative transfer have a long history; researchers in the early 20th century described the possibility that "...habits or mental acts developed by a particular kind of training may inhibit rather than facilitate other mental activities".[71] Finally, Schwarz, Bransford and Sears (2005) have proposed that transferring knowledge into a situation may differ from transferring knowledge out to a situation as a means to reconcile findings that transfer may both be frequent and challenging to promote.[72]

A significant and long research history has also attempted to explicate the conditions under which transfer of learning might occur. Early research by Ruger, for example, found that the "level of attention", "attitudes", "method of attack" (or method for tackling a problem), a "search for new points of view", a "careful testing of hypothesis" and "generalization" were all valuable approaches for promoting transfer.[73] To encourage transfer through teaching, Perkins and Salomon recommend aligning ("hugging") instruction with practice and assessment, and "bridging", or encouraging learners to reflect on past experiences or make connections between prior knowledge and current content.[70]

Factors affecting learning

[edit]
Main article: Evidence-based learning

Genetics

[edit]

Main article: Heritability of IQ

Some aspects of intelligence are inherited genetically, so different learners to some degree have different abilities with regard to learning and speed of learning.[*citation needed*]

Socioeconomic and physical conditions

[edit]

Problems like malnutrition, fatigue, and poor physical health can slow learning, as can bad ventilation or poor lighting at home, and unhygienic living conditions.[74][75]

The design, quality, and setting of a learning space, such as a school or classroom, can each be critical to the success of a learning environment. Size, configuration, comfort—fresh air, temperature, light, acoustics, furniture—can all affect a student's learning. The tools used by both instructors and students directly affect how information is conveyed, from the display and writing surfaces (blackboards, markerboards, tack surfaces) to digital technologies. For example, if a room is too crowded, stress levels rise, student attention is reduced, and furniture arrangement is restricted. If furniture is incorrectly arranged, sightlines to the instructor or instructional material are limited and the ability to suit the learning or lesson style is restricted. Aesthetics can also play a role, for if student morale suffers, so does motivation to attend school.[76][77]

Psychological factors and teaching style

[edit]

Intrinsic motivation, such as a student's own intellectual curiosity or desire to experiment or explore, has been found to sustain learning more effectively than extrinsic motivations such as grades or parental requirements. Rote learning involves repetition in order to reinforce facts in memory, but has been criticized as ineffective and "drill and kill" since it kills intrinsic motivation. Alternatives to rote learning include active learning and meaningful learning.

The speed, accuracy, and retention, depend upon aptitude, attitude, interest, attention, energy level, and motivation of the students. Students who answer a question properly or give good results should be praised. This encouragement increases their ability and helps them produce better results. Certain attitudes, such as always finding fault in a student's answer or provoking or embarrassing the student in front of a class are counterproductive.[78][79][*need quotation to verify*]

Certain techniques can increase long-term retention:[80]

- The spacing effect means that lessons or studying spaced out over time (spaced repetition) are better than cramming
- Teaching material to other people
- "Self-explaining" (paraphrasing material to oneself) rather than passive reading
- Low-stakes quizzing

Epigenetic factors

[edit]
Further information: Epigenetics in learning and memory

The underlying molecular basis of learning appears to be dynamic changes in gene expression occurring in brain neurons that are introduced by epigenetic mechanisms. Epigenetic regulation of gene expression involves, most notably, chemical modification of DNA or DNA-associated histone proteins. These chemical modifications can cause long-lasting changes in gene expression. Epigenetic mechanisms involved in learning include the methylation and demethylation of neuronal DNA as well as methylation, acetylation and deacetylation of neuronal histone proteins.

During learning, information processing in the brain involves induction of oxidative modification in neuronal DNA followed by the employment of DNA repair processes that introduce epigenetic alterations. In particular, the DNA repair processes of non-homologous end joining and base excision repair are employed in learning and memory formation.[81][82]

General cognition-related factors

[edit]
This section is an excerpt from Development of the nervous system in humans § Adult neural development.[edit]

The nervous system continues to develop during adulthood until brain death. For example:

- physical exercise has neurobiological effects
- the consumption of foods (or nutrients), obesity,[83] alterations of the microbiome, drinks, dietary supplements, recreational drugs and medications[84][85] may possibly also have effects on the development of the nervous system
- various diseases, such as COVID-19, have effects on the development of the nervous system
    - For example, several genes have been identified as being associated with changes in brain structure over lifetime and are potential Alzheimer's disease therapy-targets.[86][87]
- psychological events such as mental trauma and resilience-building

- exposure to environmental pollution and toxins such as air pollution may have effects on the further development of the nervous system
- other activities may also have effects on the development of the nervous system, such as lifelong learning, retraining, and types of media- and economic activities
- broadly, brain aging

Adult learning vs children's learning

[edit]
See also: Aging brain
[icon] This section **needs expansion**. You can help by adding to it. *(January 2023)*

Learning is often more efficient in children and takes longer or is more difficult with age. A study using neuroimaging identified rapid neurotransmitter GABA boosting as a major potential explanation-component for why that is.[88][89]

Children's brains contain more "silent synapses" that are inactive until recruited as part of neuroplasticity and flexible learning or memories.[90][91] Neuroplasticity is heightened during critical or sensitive periods of brain development, mainly referring to brain development during child development.[92]

However researchers, after subjecting late middle aged participants to university courses, suggest perceived age differences in learning may be a result of differences in time, support, environment, and attitudes, rather than inherent ability.[93]

What humans learn at the early stages, and what they learn to apply, sets humans on course for life or has a disproportional impact.[94] Adults usually have a higher capacity to select what they learn, to what extent and how. For example, children may learn the given subjects and topics of school curricula via classroom blackboard-transcription handwriting, instead of being able to choose specific topics/skills or jobs to learn and the styles of learning. For instance, children may not have developed consolidated interests, ethics, interest in purpose and meaningful activities, knowledge about real-world requirements and demands, and priorities.

In animal evolution

[edit]

Animals gain knowledge in two ways. First is learning—in which an animal gathers information about its environment and uses this information. For example, if an animal eats something that hurts its stomach, it learns not to eat that again. The second is innate knowledge that is genetically inherited. An example of this is when a horse is born and can immediately walk. The horse has not learned this behavior; it simply knows how to do it.[95] In some scenarios, innate knowledge is more beneficial than

learned knowledge. However, in other scenarios the opposite is true—animals must learn certain behaviors when it is disadvantageous to have a specific innate behavior. In these situations, learning evolves in the species.

Costs and benefits of learned and innate knowledge

[edit]

In a changing environment, an animal must constantly gain new information to survive. However, in a stable environment, this same individual needs to gather the information it needs once, and then rely on it for the rest of its life. Therefore, different scenarios better suit either learning or innate knowledge. Essentially, the cost of obtaining certain knowledge versus the benefit of already having it determines whether an animal evolved to learn in a given situation, or whether it innately knew the information. If the cost of gaining the knowledge outweighs the benefit of having it, then the animal does not evolve to learn in this scenario—but instead, non-learning evolves. However, if the benefit of having certain information outweighs the cost of obtaining it, then the animal is far more likely to evolve to have to learn this information.[95]

Non-learning is more likely to evolve in two scenarios. If an environment is static and change does not or rarely occurs, then learning is simply unnecessary. Because there is no need for learning in this scenario—and because learning could prove disadvantageous due to the time it took to learn the information—non-learning evolves. Similarly, if an environment is in a constant state of change, learning is also disadvantageous, as anything learned is immediately irrelevant because of the changing environment.[95] The learned information no longer applies. Essentially, the animal would be just as successful if it took a guess as if it learned. In this situation, non-learning evolves. In fact, a study of *Drosophila melanogaster* showed that learning can actually lead to a decrease in productivity, possibly because egg-laying behaviors and decisions were impaired by interference from the memories gained from the newly learned materials or because of the cost of energy in learning.[96]

However, in environments where change occurs within an animal's lifetime but is not constant, learning is more likely to evolve. Learning is beneficial in these scenarios because an animal can adapt to the new situation, but can still apply the knowledge that it learns for a somewhat extended period of time. Therefore, learning increases the chances of success as opposed to guessing.[95] An example of this is seen in aquatic environments with landscapes subject to change. In these environments, learning is favored because the fish are predisposed to learn the specific spatial cues where they live.[97]

In plants

[edit]

In recent years, plant physiologists have examined the physiology of plant behavior and cognition. The concepts of learning and memory are relevant in identifying how plants respond to external cues, a behavior necessary for survival. Monica Gagliano, an Australian professor of evolutionary ecology, makes an argument for associative learning in the garden pea, *Pisum sativum*. The garden pea is not specific to a region, but rather grows in cooler, higher altitude climates. Gagliano and colleagues' 2016 paper aims to differentiate between innate phototropism behavior and learned behaviors.[32] Plants use light cues in various ways, such as to sustain their metabolic needs and to maintain their internal circadian rhythms. Circadian rhythms in plants are modulated by endogenous bioactive substances that encourage leaf-opening and leaf-closing and are the basis of nyctinastic behaviors.[98]

Gagliano and colleagues constructed a classical conditioning test in which pea seedlings were divided into two experimental categories and placed in Y-shaped tubes.[32] In a series of training sessions, the plants were exposed to light coming down different arms of the tube. In each case, there was a fan blowing lightly down the tube in either the same or opposite arm as the light. The unconditioned stimulus (US) was the predicted occurrence of light and the conditioned stimulus (CS) was the wind blowing by the fan. Previous experimentation shows that plants respond to light by bending and growing towards it through differential cell growth and division on one side of the plant stem mediated by auxin signaling pathways.[99]

During the testing phase of Gagliano's experiment, the pea seedlings were placed in different Y-pipes and exposed to the fan alone. Their direction of growth was subsequently recorded. The 'correct' response by the seedlings was deemed to be growing into the arm where the light was "predicted" from the previous day. The majority of plants in both experimental conditions grew in a direction consistent with the predicted location of light based on the position of the fan the previous day.[32] For example, if the seedling was trained with the fan and light coming down the same arm of the Y-pipe, the following day the seedling grew towards the fan in the absence of light cues despite the fan being placed in the opposite side of the Y-arm. Plants in the control group showed no preference to a particular arm of the Y-pipe. The percentage difference in population behavior observed between the control and experimental groups is meant to distinguish innate phototropism behavior from active associative learning.[32]

While the physiological mechanism of associative learning in plants is not known, Telewski et al. describes a hypothesis that describes photoreception as the basis of mechano-perception in plants.[100] One mechanism for mechano-perception in plants relies on MS ion channels and calcium channels. Mechanosensory proteins in cell lipid bilayers, known as MS ion channels, are activated once they are physically deformed in response to pressure or tension. Ca2+ permeable ion channels are "stretch-gated" and allow for the influx of osmolytes and calcium, a well-known second messenger, into the

cell. This ion influx triggers a passive flow of water into the cell down its osmotic gradient, effectively increasing turgor pressure and causing the cell to depolarize.[100] Gagliano hypothesizes that the basis of associative learning in *Pisum sativum* is the coupling of mechanosensory and photosensory pathways and is mediated by auxin signaling pathways. The result is directional growth to maximize a plant's capture of sunlight.[32]

Gagliano et al. published another paper on habituation behaviors in the *mimosa pudica* plant whereby the innate behavior of the plant was diminished by repeated exposure to a stimulus.[18] There has been controversy around this paper and more generally around the topic of plant cognition. Charles Abrahmson, a psychologist and behavioral biologist, says that part of the issue of why scientists disagree about whether plants have the ability to learn is that researchers do not use a consistent definition of "learning" and "cognition".[101] Similarly, Michael Pollan, an author, and journalist, says in his piece *The Intelligent Plant* that researchers do not doubt Gagliano's data but rather her language, specifically her use of the term "learning" and "cognition" with respect to plants.[102] A direction for future research is testing whether circadian rhythms in plants modulate learning and behavior and surveying researchers' definitions of "cognition" and "learning".

Machine learning

[edit]

[icon] This section **needs expansion**. You can help by adding to it. *(February 2020)*

Robots can learn to cooperate.

Main article: Machine learning

Machine learning, a branch of artificial intelligence, concerns the construction and study of systems that can learn from data. For example, a machine learning system could be trained on email messages to learn to distinguish between spam and non-spam messages. Most of the Machine Learning models are based on probabilistic theories where each input (e.g. an image) is associated with a probability to become the desired output.

Types

[edit]

Phases

[edit]

See also

[edit]

- 21st century skills – Skills identified as being required for success in the 21st century
- Anticipatory socialization – Process in which people take on the values of groups that they aspire to join
- Epistemology – Philosophical study of knowledge
- Implicit learning – in learning psychology
- Instructional theory – Theory that offers explicit guidance on how to better help people learn and develop
- Learning sciences – Critical theory of learning
- Lifelong learning – Ongoing, voluntary, and self-motivated pursuit of knowledge
- Living educational theory
- Media psychology – Area of psychology
- Subgoal labeling – Cognitive process

Information theory

[edit]

- Algorithmic information theory – Subfield of information theory and computer science
- Algorithmic probability – mathematical method of assigning a prior probability to a given observation
- Bayesian inference – Method of statistical inference
- Inductive logic programming – learning logic programs from data
- Inductive probability – Determining the probability of future events based on past events
- Information theory – Scientific study of digital information
- Minimum description length – Model selection principle
- Minimum message length – Formal information theory restatement of Occam's Razor
- Occam's razor – Philosophical problem-solving principle
- Solomonoff's theory of inductive inference – A mathematical theory
- AIXI – Mathematical formalism for artificial general intelligence

Types of education

[edit]

- Autodidacticism – Independent education without the guidance of teachers
- Andragogy – Methods and principles in adult education
- Pedagogy – Theory and practice of education

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Further reading

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Library resources about
Learning

- Resources in your library
- *Ulrich Boser (2019). Learn Better: Mastering the Skills for Success in Life, Business, and School, or How to Become an Expert in Just About Anything. Rodale Books. ISBN 978-0593135310.*

External links

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Wikiquote has quotations related to ***Learning***.

- *How People Learn: Brain, Mind, Experience, and School* (expanded edition) published by the National Academies Press
- *Applying Science of Learning in Education: Infusing Psychological Science into the Curriculum* published by the American Psychological Association

Links to related articles

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Ethology

Branches

- Animal cognition
- Animal communication
- Animal consciousness
- Animal culture
- Animal sexual behaviour
- Animal welfare science
- Anthrozoology
- Bee learning and communication
- Behavioural ecology
- Behavioral endocrinology
- Behavioural genetics
- Breed
- Cognitive ethology
- Comfort behaviour
  - Grooming
- Comparative psychology
- Emotion in animals
- Ethogram
- Evolutionary neuroscience
- Feeding
- Hover
- Human ethology
- Instinct
- Learning
- Neuroethology
- Pain in animals
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- Sociobiology
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- Structures
  - Hive
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Ethologists	○ Patrick Bateson ○ Marc Bekoff ○ Donald Broom ○ John B. Calhoun ○ Charles Darwin ○ Marian Dawkins ○ Richard Dawkins ○ Irenäus Eibl-Eibesfeldt ○ Dian Fossey ○ Karl von Frisch ○ Jane Goodall ○ Heini Hediger ○ Julian Huxley ○ Konrad Lorenz ○ Desmond Morris ○ Thomas Sebeok ○ William Homan Thorpe ○ Nikolaas Tinbergen ○ Jakob von Uexküll ○ Wolfgang Wickler ○ E. O. Wilson ○ Solly Zuckerman
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Human intelligence topics

Types	○ Collective ○ Emotional ○ Intellectual ○ Linguistic ○ Multiple ○ Social ○ Spatial (visuospatial)

Abilities, traits, and constructs	○ Cognition ○ Cognitive liberty ○ Communication ○ Creativity ○ Fluid and crystallized intelligence ○ *g* factor ○ Intellect ○ Intelligence quotient ○ Knowledge ○ Learning ○ Memory ○ Problem solving ○ Reasoning ○ Skill ○ Thought (abstraction) ○ Understanding ○ Visual processing
Models and theories	○ Cattell–Horn–Carroll theory ○ Fluid and crystallized intelligence ○ Multiple-intelligences theory ○ PASS theory ○ Three-stratum theory ○ Triarchic theory
Areas of research	○ Evolution of human intelligence ○ Heritability of IQ ○ Psychometrics ○ Intelligence and environment / fertility / height / health / longevity / neuroscience / personality / race / sex

○ Outline of human intelligence / thought

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Learning

Non-associative learning	○ Habituation ○ Sensitization
Associative learning	○ Classical conditioning ○ Imprinting ○ Observational learning ○ Operant conditioning

Insight learning	○ Abductive reasoning ○ Deductive reasoning ○ Inductive reasoning

○ v
○ t
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Mental processes

Cognition	○ Association
	○ Awareness
	○ Cognitive flexibility
	○ Cognitive liberty
	○ Forecasting
	  ○ affective
	○ Foresight
	○ Comprehension
	○ Consciousness
	○ Critical thinking
	○ Decision-making
	○ Imagination
	○ Intuition
	○ Problem solving
	  ○ methods
	  ○ strategies
	○ Prospection

Perception	○ Amodal
	○ Color
	  ○ RGB model
	○ Depth
	○ Form
	○ Haptic (Touch)
	○ Perception as interpretation
	○ Peripheral
	○ Social
	○ Sound
	  ○ Harmonics
	  ○ Pitch
	  ○ Speech
	○ Visual

Memory	○ Consolidation ○ Encoding ○ Storage ○ Recall
Other	○ Attention ○ Experiential avoidance ○ Higher nervous activity ○ Intention ○ Ironic process theory ○ Learning ○ Mental fatigue ○ Relational frame theory ○ Mental set ○ Thinking ○ Thought suppression ○ Volition

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About regulatory compliance

For other uses of "Compliance", see Compliance (disambiguation).
"Compliance monitoring" redirects here. For third party monitoring services, see Managed service provider § Compliance monitoring.

In general, **compliance** means conforming to a rule, such as a specification, policy, standard or law. Compliance has traditionally been explained by reference to deterrence theory, according to which punishing a behavior will decrease the violations both by the wrongdoer (specific deterrence) and by others (general deterrence). This view has been supported by economic theory, which has framed punishment in terms of costs and has explained compliance in terms of a cost-benefit equilibrium (Becker 1968). However, psychological research on motivation provides an alternative view: granting rewards (Deci, Koestner and Ryan, 1999) or imposing fines (Gneezy Rustichini 2000) for a certain behavior is a form of extrinsic motivation that weakens intrinsic motivation and ultimately undermines compliance.

Regulatory compliance describes the goal that organizations aspire to achieve in their efforts to ensure that they are aware of and take steps to comply with relevant laws, policies, and regulations.[1] Due to the increasing number of regulations and need for operational transparency, organizations are increasingly adopting the use of consolidated and harmonized sets of compliance controls.[2] This approach is used to ensure that all necessary governance requirements can be met without the unnecessary duplication of effort and activity from resources.

Regulations and accrediting organizations vary among fields, with examples such as PCI-DSS and GLBA in the financial industry, FISMA for U.S. federal agencies, HACCP for the food and beverage industry, and the Joint Commission and HIPAA in healthcare. In some cases other compliance frameworks (such as COBIT) or even standards (NIST) inform on how to comply with regulations.

Some organizations keep compliance data—all data belonging or pertaining to the enterprise or included in the law, which can be used for the purpose of implementing or validating compliance—in a separate store for meeting reporting requirements. Compliance software is increasingly being implemented to help companies manage their compliance data more efficiently. This store may include calculations, data transfers, and audit trails.[3][4]

Standards

[edit]

The International Organization for Standardization (ISO) and its ISO 37301:2021 (which deprecates ISO 19600:2014) standard is one of the primary international standards for how businesses handle regulatory compliance, providing a reminder of how compliance and risk should operate together, as "colleagues" sharing a common framework with some nuances to account for their differences. The ISO also produces international standards such as ISO/IEC 27002 to help organizations meet regulatory compliance with their security management and assurance best practices.[5]

Some local or international specialized organizations such as the American Society of Mechanical Engineers (ASME) also develop standards and regulation codes. They thereby provide a wide range of rules and directives to ensure compliance of the products to safety, security or design standards.[6]

By nation

[edit]

Regulatory compliance varies not only by industry but often by location. The financial, research, and pharmaceutical regulatory structures in one country, for example, may be

similar but with particularly different nuances in another country. These similarities and differences are often a product "of reactions to the changing objectives and requirements in different countries, industries, and policy contexts".[7]

Australia

[edit]

Australia's major financial services regulators of deposits, insurance, and superannuation include the Reserve Bank of Australia (RBA), the Australian Prudential Regulation Authority (APRA), the Australian Securities & Investments Commission (ASIC), and the Australian Competition & Consumer Commission (ACCC).[8] These regulators help to ensure financial institutes meet their promises, that transactional information is well documented, and that competition is fair while protecting consumers. The APRA in particular deals with superannuation and its regulation, including new regulations requiring trustees of superannuation funds to demonstrate to APRA that they have adequate resources (human, technology and financial), risk management systems, and appropriate skills and expertise to manage the superannuation fund, with individuals running them being "fit and proper".[8]

Other key regulators in Australia include the Australian Communications & Media Authority (ACMA) for broadcasting, the internet, and communications;[9] the Clean Energy Regulator for "monitoring, facilitating and enforcing compliance with" energy and carbon emission schemes;[10] and the Therapeutic Goods Administration for drugs, devices, and biologics;[11]

Australian organisations seeking to remain compliant with various regulations may turn to AS ISO 19600:2015 (which supersedes AS 3806-2006). This standard helps organisations with compliance management, placing "emphasis on the organisational elements that are required to support compliance" while also recognizing the need for continual improvement.[12][13]

Canada

[edit]

In Canada, federal regulation of deposits, insurance, and superannuation is governed by two independent bodies: the OSFI through the Bank Act, and FINTRAC, mandated by the Proceeds of Crime (Money Laundering) and Terrorist Financing Act, 2001 (PCMLTFA).[14][15] These groups protect consumers, regulate how risk is controlled and managed, and investigate illegal action such as money laundering and terrorist financing.[14][15] On a provincial level, each province maintain individuals laws and agencies. Unlike any other major federation, Canada does not have a securities

regulatory authority at the federal government level. The provincial and territorial regulators work together to coordinate and harmonize regulation of the Canadian capital markets through the Canadian Securities Administrators (CSA).[16]

Other key regulators in Canada include the Canadian Food Inspection Agency (CFIA) for food safety, animal health, and plant health; Health Canada for public health; and Environment and Climate Change Canada for environment and sustainable energy.[17]

Canadian organizations seeking to remain compliant with various regulations may turn to ISO 19600:2014, an international compliance standard that "provides guidance for establishing, developing, implementing, evaluating, maintaining and improving an effective and responsive compliance management system within an organization".[18] For more industry specific guidance, e.g., financial institutions, Canada's E-13 Regulatory Compliance Management provides specific compliance risk management tactics.[19]

The Netherlands

[edit]

The financial sector in the Netherlands is heavily regulated. The Dutch Central Bank (De Nederlandsche Bank N.V.) is the prudential regulator while the Netherlands Authority for Financial Markets (AFM) is the regulator for behavioral supervision of financial institutions and markets. A common definition of compliance is:'Observance of external (international and national) laws and regulations, as well as internal norms and procedures, to protect the integrity of the organization, its management and employees with the aim of preventing and controlling risks and the possible damage resulting from these compliance and integrity risks'.[20]

India

[edit]

In India, compliance regulation takes place across three strata: Central, State, and Local regulation. India veers towards central regulation, especially of financial organizations and foreign funds. Compliance regulations vary based on the industry segment in addition to the geographical mix. Most regulation comes in the following broad categories: economic regulation, regulation in the public interest, and environmental regulation.[21] India has also been characterized by poor compliance - reports suggest that only around 65% of companies are fully compliant to norms.[22]

Singapore

[edit]

The Monetary Authority of Singapore is Singapore's central bank and financial regulatory authority. It administers the various statutes pertaining to money, banking, insurance, securities and the financial sector in general, as well as currency issuance.[23]

United Kingdom

[edit]

There is considerable regulation in the United Kingdom, some of which is derived from European Union legislation. Various areas are policed by different bodies, such as the Financial Conduct Authority (FCA),[24] Environment Agency,[25] Scottish Environment Protection Agency,[26] Information Commissioner's Office,[27] Care Quality Commission,[28] and others: see List of regulators in the United Kingdom.

Important compliance issues for all organizations large and small include the Data Protection Act 2018[29] and, for the public sector, Freedom of Information Act 2000.[30]

Financial compliance

[edit]

The U.K. Corporate Governance Code (formerly the Combined Code) is issued by the Financial Reporting Council (FRC) and "sets standards of good practice in relation to board leadership and effectiveness, remuneration, accountability, and relations with shareholders".[31] All companies with a Premium Listing of equity shares in the U.K. are required under the Listing Rules to report on how they have applied the Combined Code in their annual report and accounts.[32] (The Codes are therefore most similar to the U.S.' Sarbanes–Oxley Act.)

The U.K.'s regulatory framework requires that all its publicly listed companies should provide specific content in the core financial statements that must appear in a yearly report, including balance sheet, comprehensive income statement, and statement of changes in equity, as well as cash flow statement as required under international accounting standards.[33] It further demonstrates the relationship that subsists among shareholders, management, and the independent audit teams. Financial statements must be prepared using a particular set of rules and regulations hence the rationale behind allowing the companies to apply the provisions of company law, international

financial reporting standards (IFRS), as well as the U.K. stock exchange rules as directed by the FCA.[34] It is also possible that shareholders may not understand the figures as presented in the various financial statements, hence it is critical that the board should provide notes on accounting policies as well as other explanatory notes to help them understand the report better.

Challenges

[edit]

Data retention is a part of regulatory compliance that is proving to be a challenge in many instances. The security that comes from compliance with industry regulations can seem contrary to maintaining user privacy. Data retention laws and regulations ask data owners and other service providers to retain extensive records of user activity beyond the time necessary for normal business operations. These requirements have been called into question by privacy rights advocates.[35]

Compliance in this area is becoming very difficult. Laws like the CAN-SPAM Act and Fair Credit Reporting Act in the U.S. require that businesses give people the right to be forgotten.[36][37] In other words, they must remove individuals from marketing lists if it is requested, tell them when and why they might share personal information with a third party, or at least ask permission before sharing that data. Now, with new laws coming out that demand longer data retention despite the individual's desires, it can create some real difficulties.

Money laundering and terrorist financing pose significant threats to the integrity of the financial system and national security. To combat these threats, the EU has adopted a risk-based approach to Anti-Money Laundering and Combating the Financing of Terrorism (AML/CFT) that relies on cooperation and coordination between EU and national authorities. In this context, risk-based regulation refers to the approach of identifying and assessing potential risks of money laundering and terrorist financing and implementing regulatory measures proportional to those risks. However, the shared enforcement powers between EU and national authorities in the implementation and enforcement of AML/CFT regulations can create legal implications and challenges. The potential for inconsistent application of AML regulations across different jurisdictions can create regulatory arbitrage and undermine the effectiveness of AML efforts. Additionally, a lack of clear and consistent legal frameworks defining the roles and responsibilities of EU and national authorities in AML enforcement can lead to situations where accountability is difficult to establish.

United States

[edit]

Corporate scandals and breakdowns such as the Enron case of reputational risk in 2001 have increased calls for stronger compliance and regulations, particularly for publicly listed companies.[1] The most significant recent statutory changes in this context have been the Sarbanes–Oxley Act developed by two U.S. congressmen, Senator Paul Sarbanes and Representative Michael Oxley in 2002 which defined significantly tighter personal responsibility of corporate top management for the accuracy of reported financial statements; and the Dodd-Frank Wall Street Reform and Consumer Protection Act.

The Office of Foreign Assets Control (OFAC) is an agency of the United States Department of the Treasury under the auspices of the Under Secretary of the Treasury for Terrorism and Financial Intelligence. OFAC administers and enforces economic and trade sanctions based on U.S. foreign policy and national security goals against targeted foreign states, organizations, and individuals.

Compliance in the U.S. generally means compliance with laws and regulations. These laws and regulations can have criminal or civil penalties. The definition of what constitutes an effective compliance plan has been elusive. Most authors, however, continue to cite the guidance provided by the United States Sentencing Commission in Chapter 8 of the Federal Sentencing Guidelines.[38][39]

On October 12, 2006, the U.S. Small Business Administration re-launched Business.gov (later Business.USA.gov and finally SBA.Gov)[40] which provides a single point of access to government services and information that help businesses comply with government regulations.

The U.S. Department of Labor, Occupational Health and Safety Administration (OSHA) was created by Congress to assure safe and healthful working conditions for working men and women by setting and enforcing standards and by providing training, outreach, education, and assistance. OSHA implements laws and regulations regularly in the following areas, construction, maritime, agriculture, and recordkeeping.[41]

The United States Department of Transportation also has various laws and regulations requiring that prime contractors when bidding on federally funded projects engage in good faith effort compliance, meaning they must document their outreach to certified disadvantaged business enterprises.[42]

See also

[edit]

Wikimedia Commons has media related to ***Regulatory compliance***.

- Business Motivation Model - A standard for recording governance and compliance activities

- Chief compliance officer
- Corporate social responsibility
- Environmental compliance
- Governance, risk management, and compliance
- International regulation
- Professional ethics
- Regulatory technology

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- Japan
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Frequently Asked Questions

What is the primary cause of claim denials in medical coding?

The primary cause of claim denials often stems from incomplete or inaccurate documentation. This can include missing patient information, incorrect coding for procedures, or lack of necessary supporting documentation.

How can better documentation directly impact denial rates?

Better documentation ensures that all necessary details are accurately captured and coded, which reduces errors and omissions. This leads to fewer claims being denied due to

insufficient information or discrepancies between clinical notes and billing codes.

What steps can healthcare providers take to improve documentation quality?

Healthcare providers can implement regular training sessions on proper documentation practices, utilize electronic health records (EHR) systems effectively, perform routine audits for accuracy, and encourage clear communication between coders and clinicians.

Why is it essential for coders to stay updated with current coding guidelines?

Staying updated with current coding guidelines is crucial because medical codes frequently change due to new treatments, technologies, and regulations. Up-to-date knowledge helps ensure that the correct codes are used, reducing the likelihood of denials due to outdated or incorrect coding.

What role does collaboration between medical staff play in reducing denial rates?

Collaboration between medical staff—including physicians, nurses, and coders—ensures that all parties understand the importance of accurate documentation. This teamwork facilitates precise data capture during patient encounters and improves overall compliance with billing requirements.

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